

- 9 -

Claims

1. An ion conductive membrane, comprising:
a membrane material; and
a metallofullerene in said membrane material.
- 5 2. The membrane of claim 1, wherein said metallofullerene increases the ionic conductivity of the membrane at elevated temperatures.
3. The membrane of claim 1, wherein said metallofullerene
10 comprises a trimetasphere.
4. The membrane of claim 3, wherein said trimetasphere includes portions derivatized on an outer portion of the carbon fullerene cages with organic or inorganic group or groups.
- 15 5. The membrane of claim 1, wherein said metallofullerene comprises nitrogen.
6. The membrane of claim 1, wherein said metallofullerene
20 comprises a rare earth element.
7. The membrane of claim 1, wherein said metallofullerene comprises a group III element.
- 25 8. The membrane of claim 1, wherein said metallofullerene comprises Sc, Y, La, Ce, Pr, Nd, Gd, Dy, Ho, Er, and/or Tm.
9. The membrane of claim 1, wherein said membrane material
30 comprises polysulphone (PSU), polyether sulphone (PES), cellulose acetate (CA), polyacrylonitrile (PAN), polyether etherketone (PEEK), polyimide (PI), and/or polybenzimidazole (PBI).

- 10 -

10. The membrane of claim 1, wherein membrane comprises an ion conductive membrane.

5 11. A fuel cell, comprising:
a cathode;
an anode;
an ion conductive membrane between the cathode and the anode;
and
a metallofullerene in said membrane.

10

12. The fuel cell of claim 11, wherein said metallofullerene increases the ionic conductivity and mobility of the membrane at elevated temperatures.

15

13. The fuel cell of claim 11, wherein said metallofullerene comprises a trimetasphere.

20

14. The fuel cell of claim 13, wherein said trimetasphere includes portions derivatized on an outer portion of the carbon fullerene cages with organic or inorganic group or groups.

15. The fuel cell of claim 11, wherein said metallofullerene comprises nitrogen.

25

16. The fuel cell of claim 11, wherein metallofullerene comprises a rare earth element.

30

17. The fuel cell of claim 11, wherein said metallofullerene comprises a group III element.

18. The fuel cell of claim 11, wherein said metallofullerene comprises Sc, Y, La, Ce, Pr, Nd, Gd, Dy, Ho, Er, and/or Tm.

- 11 -

19. The fuel cell of claim 11, wherein said membrane material comprises polysulphone (PSU), polyether sulphone (PES), cellulose acetate (CA), polyacrylonitrile (PAN), polyether etherketone (PEEK), polyimide (PI),
5 and/or polybenzimidazole (PBI).

20. The fuel cell of claim 11, wherein membrane material comprises an ion conductive membrane.

10 21. A method of using an ion conductive membrane in a fuel cell, comprising:

placing an ion conductive membrane in the fuel cell, wherein said membrane comprise a membrane material and a metallofullerene; and

15 elevating a temperature of said fuel cell to above about 100°C, wherein said metallofullerene increases ionic conductivity and mobility and thermal stability of the membrane above about 100°C.

22. The method of claim 21, wherein said metallofullerene comprises a trimetasphe-
20